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The purpose of this study was to measure nonverbally the preference of alternative responses when the net probability of being rewarded was the same. A demonstration of preference under these circumstances would suggest the ability to control or maintain behavior without explicit administration of a reinforcing agent. Head Start children were used as subjects. They were provided, in the experimental situation, with a two-button console. The right button, when pushed, resulted in the illumination of a yellow light and the dispensing of a penny for every second illumination (a consistent reward schedule). The pushing of the left button would result in a 50 percent chance of the illumination of a red light, which was never followed by reward, and a 50 percent chance of the illumination of a green light, which was always rewarded. Thus, whichever button was pushed, there followed a net 50 percent chance of reward. However, only the right button provided a consistent 50 percent reward. The results indicate that children prefer a consistent reward situation to a reward uncertainty situation. (WD)

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HEAD START EVALUATION AND RESEARCH CENTER

A Study of Preferences Among Qualitatively Differing Uncertainties[1]

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ABSTRACT

Head Start children participated in an experiment in which rewards were made available. Regardless of the child's position response (right or left) the probability of reward was always p=.5. Discriminative stimuli were made available; one side imperfectly correlated with the subsequent availability of reward, the other perfectly correlated. Preference for the "consistent side" was evidenced. Implications for application as a non-verbal diagnostic and training model are discussed.

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HEAD START EVALUATION AND RESEARCH CENTER

A STUDY OF PREFERENCES AMONG QUALITATIVELY DIFFERING UNCERTAINTIES[1]

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Problems in thinking and concept formation have had a long history in the literature of Psychology. It is only relatively recent, however, that the focus of interest has turned to an adaptation of refined techniques in response to questions of concern such as decision processes in children as a function of stimulus as well as cultural conditions has been observed by many. The Educational Testing Service has for one had more than a casual interest in the nature of such choice responding. A series of papers (representative of the work by Rosenhan (1966a) is evidence of such studies. The Rosenhan type of study has not contented itself with the examination of alternation behavior in the neutral laboratory, but has been equally concerned with the affects of social class and race on responsiveness to the effects of reinforcement (Rosenhan 1966b). The purpose of the present study is also directed to a specific activity of choice and preference. The particular interest in this study is to utilize a non-verbal task which can give evidence of preferences exhibited under conditions of equal satisfaction(reward). Such a demonstration would suggest the ability to control or maintain behavior without explicit administration of a reinforcing agent. Historically, this problem might be though of as beginning with a master's dissertation by Prokasy(1956) and extended more recently by Bower et.al(1966). The model inherent in these investigations may also be seen in a series of studies pursued by Weir (1964, 1965) in which children's preferences were observed independent of reward consequences.

A number of conditions strongly argue for investigating alternative behavioral techniques which might be of general value both for diagnostic and remedial purposes. Principally, such techniques would place minimal emphasis or requirement on the use of verbal behavior. To the extent that debilitations of either a cultural of intellectual nature affect the learning or other performance capabilities of children and adults, the wisdom of using any verbal based investigatory or measurement scheme seems highly questionable. A host of theoretical issues surround this problem of non-verbal alternatives, not the least of which concerns a position formulated most explicitly by B,F. Skinner, viz. that the most complicated classes of human and infrahuman behaviors are subject to the same fundamental laws of control. In dealing with the problems and objectives of learning in children, and adults, the advent of program instruction and teaching machines have tended to demonstrate the efficacy of reinforcement and its associated schedule of dispensation. The data tend to convey an expectancy of success in the modification or maintenance of verbal and other behaviors by recourse to known and existing reinforcement schemes. These procedures and schemes usually differ with respect to parameters such as the magnitude, frequency, and rate of reinforcement availability. Staats and Staats(1963) in their work "Complex Human Behavior" discuss a number of variables which have successfully been explored in conjunction with the study and control of human behavior.

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Outside the laboratory situation, however, the realities of utilizing primary reinforcement would seem constraining features for large-scale implementation. Instrumentation problems aside, certain sub-classes of the subjects, who might otherwise benefit most from the favorable features of these procedures, may well suffer from unanticipated problems, such as the utility of the reinforcement; i.e. the subjective utility of the reinforcement as perceived by the subject. Such a hypothesis was advocated by Rosenhan in a series of studies executed under the aegis of ETS. Their studies suggested the instability of reinforcement utilities, and that the perceived value of the reinforcement differs as a function of racial group membership. It would appear desirable, therefore, to (1) capitalize on the desirable qualities of the reinforcement and operant approach, (2) incorporate the technology of the experimental analysis of behavior in investigating not only learning behaviors, but the less articulatable qualities which surround the learning situation, and (3) to bypass the liabilities of utility, satiation, etc. which accompany the use of primary reinforcement. The present study represents a modest attempt to satisfy these criteria.

The theme of this study may be simply described as measuring non-verbally the preference among alternatives whose net probability of payoff is the same. Weir(1964) had investigated a situation where children were able to manipulate one of two plunges-left or right. The left plunger was programmed so as to dispense reinforcement alternately i.e. 50% of the time (every other response), while the right plunger was also programmed to dispense reinforcement 50% of the time, however on a random basis. In general, the left plunger was preferred. Subsequent extensions of this design enabled Weir to program the right plunger for values other than 50%. Weir interpreted his experiment as demonstrating preferences under the conditions of consistency (alternate) versus non-consistency (random), since children indicated a preference for the "consistent" side. There are several difficulties in this kind of interpretation: (1) to identify the preference as between the consistence versus non-consistence, does not offer any additional explanatory value. The terminology or concept of consistency as used essentially describes the technique alone. While it may be a convenient label for the experimenter to differentiate the plungers with respect to the rules with which reinforcement is made available, it has no other embellishingor connotative properties. It certainly contributes nothing to an account of the subject's behavior. It only accounts for the behavior of the machinery. (2) The Weir experiment, when looked at closely, is nothing more than a comparison of components in a concurrent schedule. The alternating schedule (in which every other trial pays off) is a fixed ratio of 2 (FR2), whereas the random schedule is a variant of the VR or VI schedule. Weir's data, therefore, are consistent with the comparisons of data from incompatable concurrent schedules as described by Catania(1966). It does not, however, demonstrate control by any feature other than the schedule.

A different paradigm was, therefore, adopted in the present study. The approach derives from a master's thesis by Prokasy who used rats in a T maze situation. The legs of the T were varied such that the right leg, painted striated, always led to a delay chamber which was also striated. Following a delay period in the striated chamber the animal was released to the end of the arm in which reinforcement was either made available or not made available, with a probability of .5. If the animal chose the left arm of the T maze, he entered a delay chamber which was either striated or solid color. If it was striated, release from the chamber was constantly followed by reinforcement. If it was not striated, release was never followed by reinforcement i.e., CRF versus extinction. Again, the probability of CRF or extinction was .5.

The net expected probability of payoff to either side of the T maze was, therefore, the same. The animal's preference for one arm over the other would reflect his preference for a payoff consistently associated with some discriminative property of the delay chamber rather than a payoff not consistently associated with some discriminative property of the delay chamber. Prokasy found a preference for "the consistent side." His interpretation relies heavily on the hypothesized optimization of anticipatory salivating behavior which the animal undertakes in the delay chamber and which facilitates the terminal consummatory response. Such a preference, if found with humans, would not lend itself to the anticipatory salivating explanation, although it very well might lend itself to an explanation of added reinforcement in a form of conditioned reinforcement provided by the association of the discriminative stimulus with the payoff. It is this model which has been incorporated in the present study. The data would enable a general statement of preference (the control of performance) between responses of different topologies having equally objective probabilities of payoff by subjects for whom learning and cultural deprivations may differ. This differs from the Weir experiment in that the reinforcement schedule is identical in both response models. Consistency may thus be meaningfully ascribed to the situation in relation to the predictability of reward subsequent to the onset of a discriminative stimulus.

Procedure

Subjects were brought to a room (which was part of a two-room suite) in which one wall was a one-way observation mirror. The subject's room housed a response console (see figure 1). The subject's working area on the console contained two buttons (Microswitch#2C206) which when depressed actuated a double pole-switch. The buttons were 5" apart. Each unit could be illuminated independent of either the subject's responses or the switching function. Facing the subject was a screen which deflected pennies which were dispensed from a Gerbrand feeder mounted in the rear of the console. Above the feeder-shield was mounted a resettable six-digit counter. Control equipment was housed in the adjacent experimenter's room. The control equipment was programmed such that continuous operation of the right button caused it to become illuminated yellow on the average of every 20 seconds. Once a switch became illuminated all other functions on the console remained inoperative until that same lit key was depressed again. The subject, therefore, had to respond to the yellow button (i.e. the illuminated manipulandum) for any functional change to take place for him. Responding to the yellow button led to a dispensing of reinforcement on a random average of 50% of the time. The subject's reinforcement consisted either of an increase in the counter, a dispensing of a penny, or both. The button light would then go off and the session continued. In the case of children the use of the penny was defined not for its own utility but rather served as a token. Prior to the session the subject was invited to a room containing a toybin from which he selected a toy of his choice. He was then told he would be playing a game for which he might earn pennies and each penny was to be placed in a bank which was a transparent jar. When the jar was filled the toy of the child's choice would then be given to him. Both the toy and the jar were constantly in the subject's view during the course of the experiment (procedure of Staats and Staats).

With respect to the right button, therefore, on the average it would become lit, the probability of reinforcement following yellow, equal to .5. Continual operation of the left button would occasionally (VI of 20) also turn color. However, 50% of the time it would turn red, 50% of the time, green. The consequence of

operating the left button once it was lit was perfectly correlated with its color. If the button was red, its operation would simply lead to the termination of the color and no reinforcement made available. If the button was green, its operation would lead to a dispensing of reinforcement followed by termination of the color and the session continued. All responses and latencies were recorded. Response rate was recorded on standard cumulative recorders. The subjects for the experiment were recruited from an available Headstart center in operation in Revere, Massachusetts. They were transported in groups of three from Revere to the experimental chambers at our laboratory and were individually tested for the duration of the experiment. Other subjects were selected for the experiment from among those participating in on-campus programs. The subjects included adults as well as children. All subjects were first tested for color blindness using the Dvorin Pseudoisochromatic Charts. The analyses of interest with respect to the data, concerns the preference of the left red/green button over the yellow button, i.e., the consistent versus the non-consistent side with respect to a) total number of responses, b) the relative frequency of responding, c) the rate of responding and d) the latency of responses, respectively. The experiment is continuing for several reasons: (1) the sample size precludes the use of powerful tests and, therefore, inadequate for any definitive conclusions, (2) certain control conditions are yet to be run, among them extinction following preference behavior and the use of yellow-blue each with a 25% reinforcement compared to the red-green (as a counterbalance for the possible novelty effects).

The results give evidence that a) children will prefer a "consistent" reward situation to a reward uncertainty situation. This preference was exhibited to some degree by each child tested. The data taken collectively are in agreement, i.e. response rate, total response output, and response latency. b) Adults, while seeking to arrive at an optimal "strategy" for maximizing payoff, also behave under the control of the control of the uncertainties. c) The individual differences and variability exhibited in the extent of preference can be minimized - and the preference correspondingly accentuated - by introducing a change-over delay. We have done this manually and plan in succeeding experiments to build it in as a feature of our logic and control instrumentation.

These findings strongly argue for sober reconsideration of the effectively controlling stimuli in an applied learning situation. While not deprecating the force of reward per se, the data clearly imply that much learning can be efficiently directed by the manipulation of other environmental features - some of which may be considered to have acquired secondary or conditioned reinforcement properties. It would seem imperative to attempt a translation of these findings for implementation in the classroom. The need is even greater where mere increases in reward is contraindicated. The experiments will be continued and will involve larger numbers of experimental units for adults, normal children, retardates. In addition, supportive experimentation will be concurrently pusued i.e.

1) extinction following stabilized behavior (using existing schedule)

2) extinction following stabilized behavior (using change-over delay)

3) forced trials to each manipulandum condition

4) red-green <u>us</u> yellow-blue (instead of r-g <u>us</u> y-y)

The conduct of such laboratory investigations surely constitutes a necessary prerequisite for effective large scale adaptation and for increasing the effectiveness of educational practices in the real and applied world.

The data analyzed thusfar suggests that the predictions which would have been expected on the basis of reinforcement theory are substantiated in these studies. As such, its suggested relevance to the applied situation becomes quite substantial if the reliability of these findings are justified. That is, it does suggest that the use of secondary reinforcement may be an applicable reinforcer for Headstart programs. If this is the case, the failings which are encountered with primary inforcement situations might be avoided and would not be sensitive to individual differences with respect to utility, satiation, or other factors related to racial and ethnic composition. Furthermore, it strongly suggests the advisability of paying closer heed to whatever reinforcement qualities attend the consistency of reinforcement schedules. It further suggests that the reinforcing advantages of discriminative stimuli should not be overlooked even when primary reinforcement is used. Perhaps a behavioral analysis of "consistency" may yet be profitable.

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